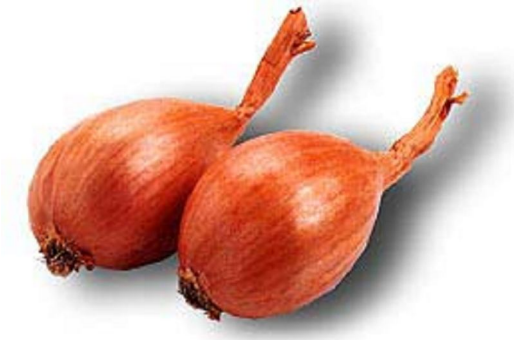
RIBATEJO - PORTUGAL

VEGEPOLYS
competitiveness cluster

« Innovating breeding for food »



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International Project Manager (permanent contact: Pauline CAPUS)

VEGEPOLYS :
3 main areas of innovation for plants
with lower resource consumption or focused on diversification

Plant breeding

Plant protection and cropping systems

Plants for health, well-being and human environment

Three main areas of innovation categorised as technological challenges (1/3)

• Plant Breeding

The 4 challenges are categorised to guarantee adequate productivity and production regularity.
All the markets incorporating plant production are targeted including the urban market.

– **1st challenge :** To create and manage in a sustainable manner varieties that are resistant or tolerant to bio-aggressors

– **2nd challenge :** To adapt the varieties to abiotic stresses, especially to climate change

– **3rd challenge :** To identify and select high quality, original characteristics appealing to producers, processors, distributors/marketers and consumers

– **4th challenge :** To optimise the plant creation processes by developing integrative approaches

Three main areas of innovation categorised as technological challenges (1/3)

- **Plant protection and cropping systems**

– **1st challenge :** To develop knowledge of bio-aggressors and their interaction with the host and
to formulate reliable and rapid methods of detection, diagnosis and evaluation of the plant resistance.

– **2nd challenge :**
To develop crop protection products with low risk to man and the environment including biocontrol agents and reliable methods suitable for evaluating their efficency.

– **3rd challenge :** To develop global integrated protection strategies

Three main areas of innovation categorised as technological challenges (1/3)

- **Plants for health, well-being and human environment**

– **1st challenge :** To develop products from plants dedicated to human and animal food/nutrition, health and well-being

– **2nd challenge :** To design plant-based urbanised areas and specific management methods

which

- reduce inputs
- conserve resources
- promote biodiversity and climate regulation,

in order to improve the well-being (physical, psychological) and lifestyle of the population

Plant breeding - The main research areas

1st TECHNOLOGICAL CHALLENGE	
To create and manage sustainably productive varieties that are resistant or tolerant to bio-aggressors	
Synopsis	**Research areas**
To create varieties sustainably resistant to bio-aggressors	• Characterisation and management of genetic resources • Development of innovative aids to the selection of new varieties • New genotyping and genome identification tools • New phenotyping methods (high speed, non destructive) • Adaptation of populations and durability of resistance **Complementary research areas** • Knowledge of the molecular mechanisms of plant-bioaggressor interactions • Knowledge of the bioaggressors and epidemic mechanisms • Strategies and methods for management of the biotic stresses in agro-ecosystems • Conservation based selection and quality of seeds

Plant breeding - The main research areas

2nd TECHNOLOGICAL CHALLENGE	
To adapt varieties to the abiotic stresses, especially climate change	
Synopsis	**Research areas**
To modify and adapt varieties: increasing their flexibility towards fluctuations (soil, water, temperature)	• Understanding of the physico-chemical mechanisms governing the interaction between the plant and its aerial and root environment • Tolerance, protection and regulation mechanisms for abiotic stresses and survival when dry (seed drought tolerance and longer life) and modelling of germination and sprouting • Measuring and predicting the impact on the plant of variations due to climate (global warming) or the urban environment (modelling) • Design of ideotypes = variety + suitable methods of cropping

Plant breeding - The main research areas

3rd TECHNOLOGICAL CHALLENGE

To identify and select high-quality, original characteristics appealing to producers, processors, distributors/marketers and consumers

Synopsis	Research areas
To create high-quality varieties suitable for: – the stresses of the cultivation, marketing and processing systems (technological quality, conservation) – consumer demand (originality, appearance, taste, aroma...) – the health and well-being needs of people and animals (substances of nutritional value) and plants (molecules of crop protection value) due to their wealth of active principles – the development of new uses and markets	• Characterisation of the plant metabolites and their properties • Impact of the environment on expression of the product quality characteristics • Socio-economic study of the impact of the development of new markets or channels

Plant breeding -
The main research areas

Research areas common to these three challenges

- Characterisation and management of the genetic resources:
  analysis of the genetic determinism of the characteristics of value and
  localisation of the genes controlling these characteristics

- Development of innovative aids to selection of new varieties including:
  marker-assisted selection and genome selection

- Conservation-based selection and quality of seeds

Plant breeding -
The main research areas

4th TECHNOLOGICAL CHALLENGE

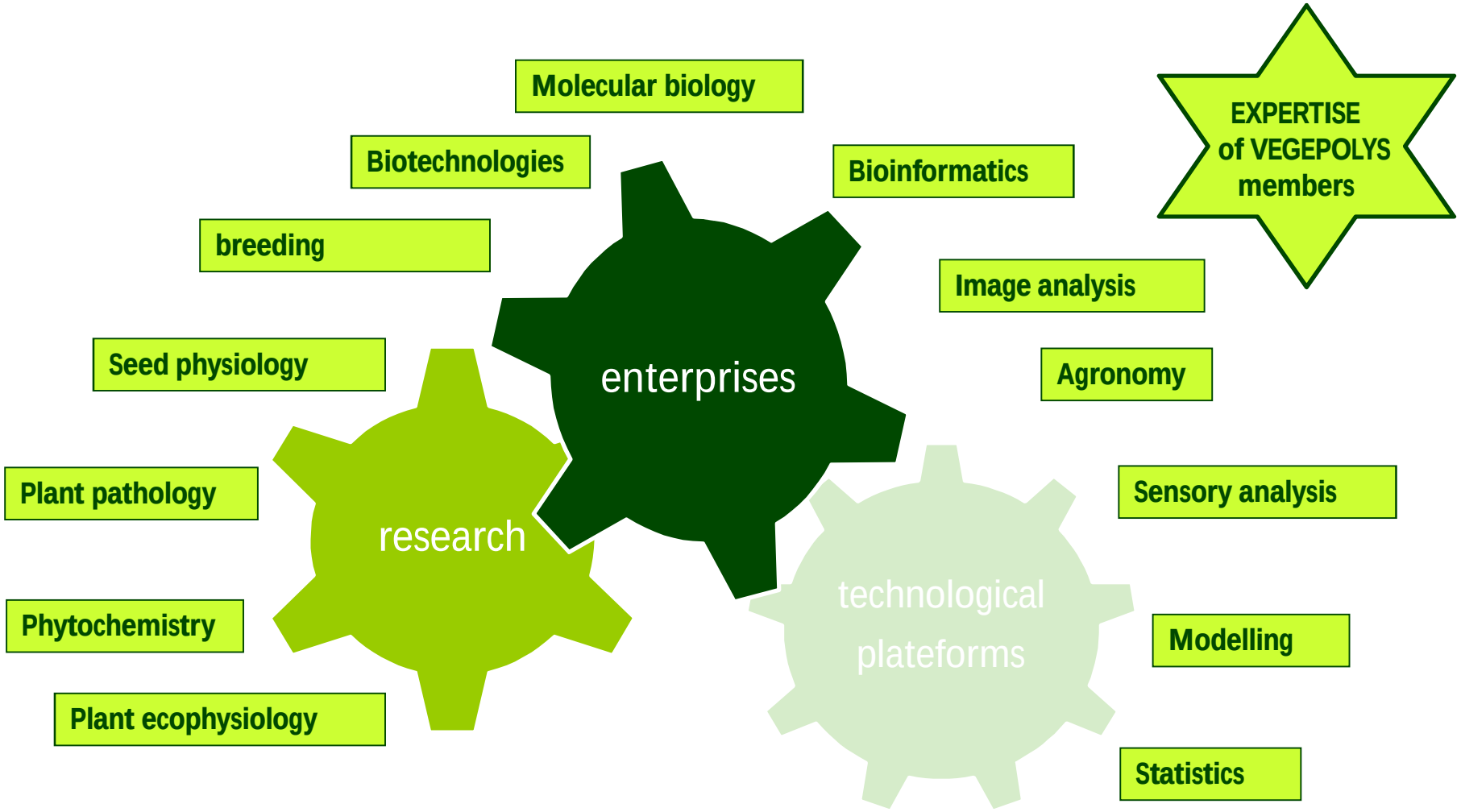
To optimise the variety creation processes through the development of integrative approaches

Synopsis	Research areas
To optimise the variety creation processes through a total data integration approach	• Study of the physiological and molecular mechanisms involved in the expression, regulation and interaction of the characteristics of value • Development of new data processing algorithms • Data modelling and ideotype prediction

Plant breeding - Identification of bottlenecks

TECHNOLOGY and METHODOLOGY				
	1st challenge : « Resistance to bio-aggressors »	2nd challenge : « Environmental stresses »	3rd challenge : « Quality/ originality »	4th challenge : « Integrative approaches »
Create genetic variability	X	X	X	
Identify the genetic bases of the characteristics of interest and their heredity	X	X	X	
Design new genotyping and genome identification tools	X	X	X	
Design new phenotyping methods (high speed, non destructive)	X	X	X	
Manage and process large volumes of different data (quality and quantity)	X	X	X	X

The strengths of VEGEPOLYS for plant breeding projects



Plant breeding - Local resources in research

RESEARCH STRENGTHS	Challenges			
	1 « Resistance to bio-aggressors »	2 « Environmental stresses »	3 « Quality/originality »	4 « Integrative approaches »
Angers –**IRHS** (Institute Horticulture and Seed Research) INRA/Agrocampus-ouest/ University of Angers	X	X	X	X
Rennes - **IGEPP** (Institute of Genetics, Environment and Plant Protection), INRA/Agrocampus-ouest/ University of Rennes	X	X	X	X
Nantes - **LBPV** (Laboratory of Biology and Vegetable Pathology) University of Nantes	X			
Angers - **GEVES : SNES** (National Seed Testing Station) and **SEV** (Evaluation Service of Varieties)	X	X	X	
Angers - **LEVA** (Laboratory of Vegetable and Agro ecology Ecophysiology) ; ESA		X		
Angers – **UP EPHOR** (Physical Environment of the Horticultural Plants) West Agro campus INHP		X	X	
ITEIPMAI (Inter-professional Technical Institute of Perfumed, Medical and Aromatic Plants)	X	X	X	
Nantes – **UR BIA** (Biopolymers Interactions Assemblies) – INRA			X	
Angers –**SONAS** Laboratory (Substances of Natural Origins and Analogical Structures) – University of Angers			X	
Angers – **GRAPPE** (Research group in agro alimentary of products and processes) - ESA			X	
Angers – **LISA** – University of Angers	X	X	X	X
Angers – **LAREMA** (Angevin Laboratory of Mathematical Research) –University of Angers				X
Angers - VEGEPOLYS INNOVATION	X	X	X	
Bretagne - Végénov - BBV	X	X	X	
Angers – **UVV** (Vine and Wine Unity), INRA	X	X	X	
Cée – **IFPC** (French Institute of Cider Productions)	X	X	X	
Centre – **CDHR** (Astredhor Network)	X	X	X	
CTIFL (Inter-Professional Technical Center of Fruit and Vegetables)	X	X	X	
Saumur – **CTC** (Technical Center of Mushrooms)	X		X	
Le Mans – **FNPC** (National Federation of Hemp Producers)			X	

Plant breeding - Local resources “enterprises”

ENTERPRISE TYPES	MEMBERS OF VEGEPOLYS	
Vegetable/flower seed companies	HM - Clause Vilmorin Syngenta Gautier Technisem Bejo Enza Zaden	Gautier semences Graines Voltz Interseed Plan ornemental UCA OBS A.Ducrettet
Other seed companies	Limagrain Jouffray Drillaud Florimond-Desprez	Sylvan Somycel Agriobtention
Ornamental production	Minier Melba Hydranova Eurogeni Florinov André Briand jeune plant Barrault Horticulture Boos hortensia Chauvin diffusion Pierre Turc Ernest Turc production Saulais	Gaignard Fleurs Hortensia France Production Les Agrumes de Méditerranée Les serres du Lodevois Malinge horticulture Morel Diffusion Pép. et roseraies Georges DELBARD Pép. Nicolandes Pép. Renault Sapho Production SICAMUS
Agricultural cooperatives	Fleuron d’Anjou Maraichers nantais	Rosée des Champs Coop. producteurs de semences de chanvre
Fruit selection companies	CEP innovation GIE IFO Davodeau Ligonnière Fraise concept	Mondial Fruit selection Selection new plant

VEGEPOLYS

”Plant in

FruitBreedomics :
European research project co-financed by the 7thFP.
Aim : To improve the efficiency of fruit breeding by bridging the gap between scientific genetic research and application in breeding.

BRIO : Breeding, Research and Innovation on Ornamentals **:**
“FUI” project with 18 companies small to medium size.
Development of an innovative decision-making tool and integration in the variety creation strategy of enterprises in the ornamental sector

Carot Pigments:
Cooperative project funded by the regional council.
Study of the pigment diversity of the carrot for the development of new varieties focussing on their nutritional qualities

Radiallis :
project funded by the regional council with 3 seed companies and producers.
Research on mildew resistance in the radish

Quality legseed :
Academic research project funded by ANR.
An integrated approach using Medicago truncatula to identify key genes controlling nutritional and physiological quality of vegetable

QUALISEM :
Academic research project funded by the region council
Integrative approach to determination of the physiological and health quality of the seeds

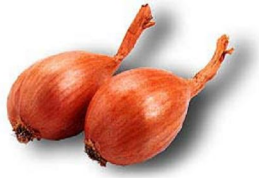
COSI-VEG:
Academic research project funded by the regional council.
Innovative Cognitive and Sensory Methodologies suitable for the enhancement of Plant material

CVP : Breeding on vegetables**:**
“FUI” project with 2 seed companies.
Research on genes resistant to carrot *alternaria*

Plant breeding - Projects for the future

IDEAS

- Project currently being set up which includes the components : research, training and innovation : « Multi-scale phenotyping aimed at sustainable management of horticulture plant health"
- Genome Sequencing and Resequencing of orphan plant species
- Development of new phenotyping tools (development of dedicated platforms or transfer/development in the enterprises)
- Development of new selection methodologies or new selection tools (e.g. : transcriptomics)
- Improving the germinative quality of the seeds to tolerate the stresses associated with climate change and the reduction in phytosanitary products
- Creation of new products (diversification) in order to develop new markets
- Evolution of varieties for new uses

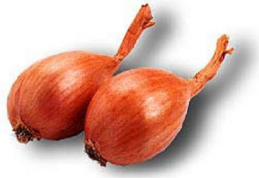


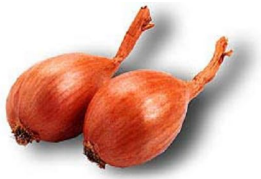



Collaborative project « Legtyp »

Varietal innovation in vegetables typical of Anjou

3 years' research from 2007 to 2009
With financial support from the
Pays de la Loire Regional Council and the State



The partner enterprises

Cooperatives:

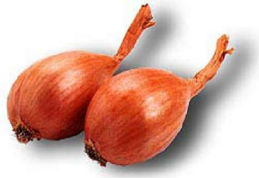
Fleuron d'Anjou
Fleurs Plantes Fruits Légumes

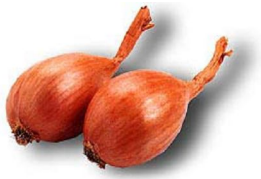
Rosée des Champs
Coopérative des producteurs légumiers

Breeders:

ENZA ZADEN

agri obtentions



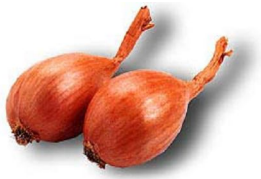



From idea to concrete realisation

Context :

- “Orphan” produce
- Players with the will to work on specific vegetable varieties (typical of the area)
- Growing interest in traditional produce on the part of the consumer
- A favourable relationship network and Végépolys as facilitator of innovative cooperative projects



From idea to concrete realisation

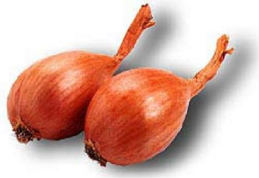
Objectives :

• **On shallots :** new varieties better suited to the production area (*e.g.*: fusariosis tolerance) and more diverse (white and grey shallots).

Establishment of a variety repository.

• **On Jerusalem artichokes :** new varieties adapted to the 21st century and suitable for the 5th range.

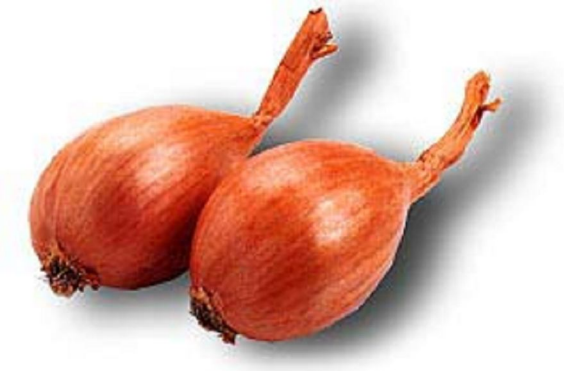
• **On "Cornet d'Anjou" chicory :** identify varieties suitable for the 4th range and having a longer production period.



Échalotes Traditionnelles

The shallot in Anjou

2nd largest producing region in France



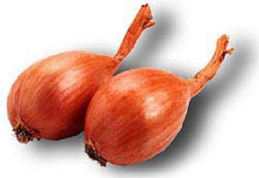
At Fleuron d'Anjou :

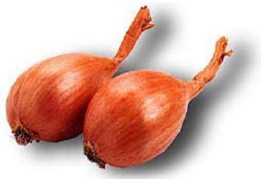
200 ha planted
40 operations
3000 tonnes

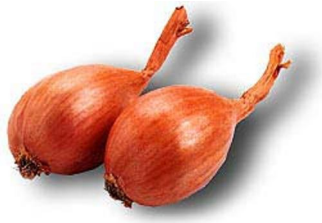
The only certification
of a traditional long shallot.

CRITÈRES QUALITÉ CERTIFIÉS
décret du 12.03.96


MECOPIC
362





The partners in the “shallot” programme

Fleuron d'Anjou
Fleurs Plantes Fruits Légumes

agri obtentions

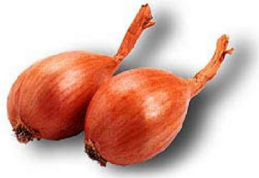
Breeding
Variety repository

université angers

Laboratory pathology studies

AGRO CAMPUS OUEST

Experimentation in tunnels and greenhouses





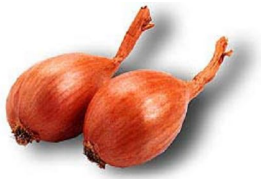

Advanced research

- **In the field :**

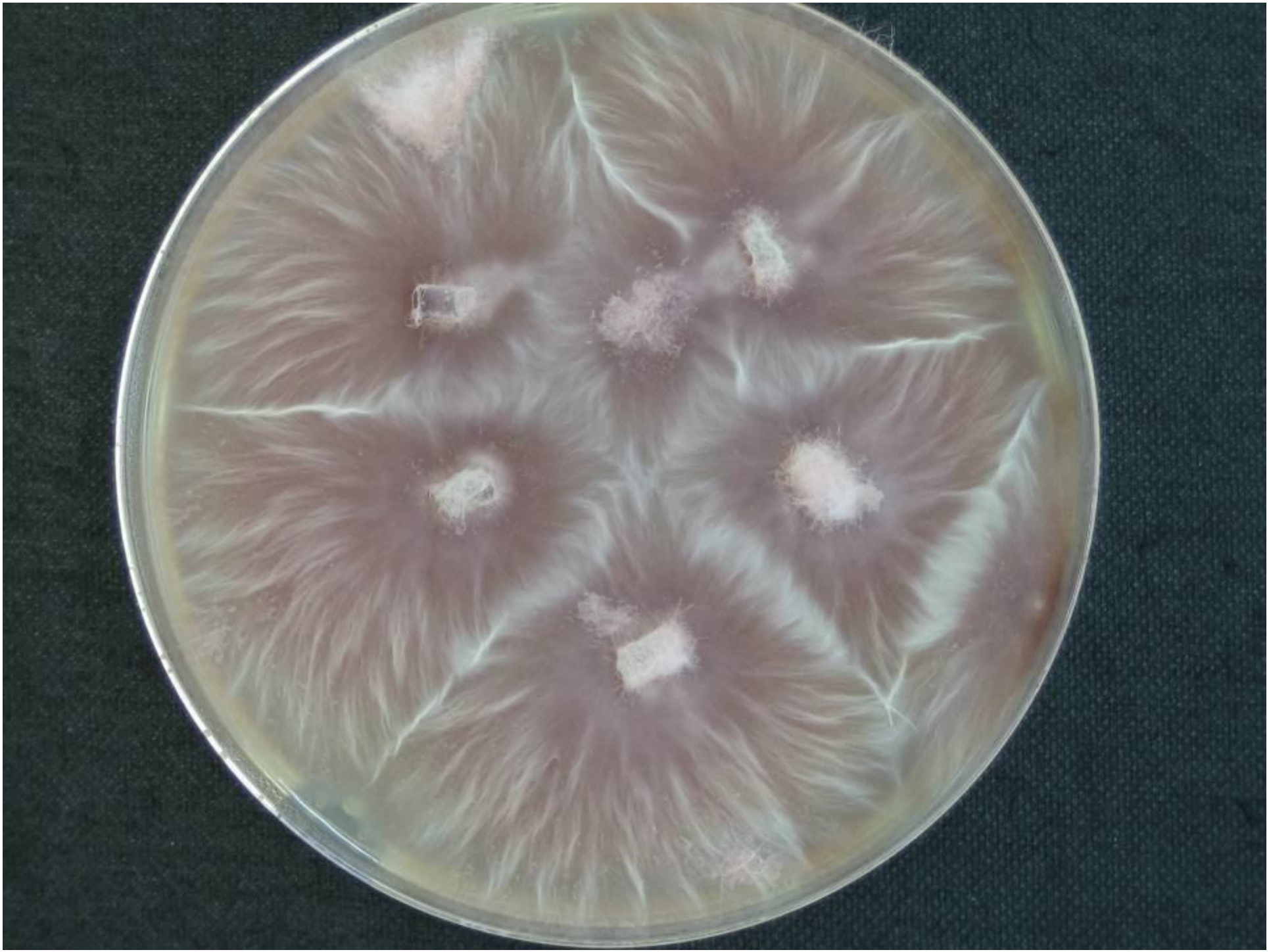
  Experimental sites on the farms

- **In the laboratory / greenhouse :**

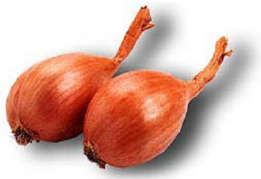
  Work carried out in the University of Angers laboratories and the INH greenhouses.




Mik. Tmo - HT





On shallots
Evaluation at the end of the 3rd year

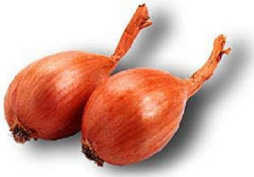
- Variety creation process under way

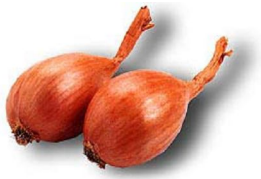
- Prospect of obtaining varieties resistant to the main parasites found in Anjou

- Several improved varieties already recorded and accompanied by a registration and production plan.

Concrete result **:**

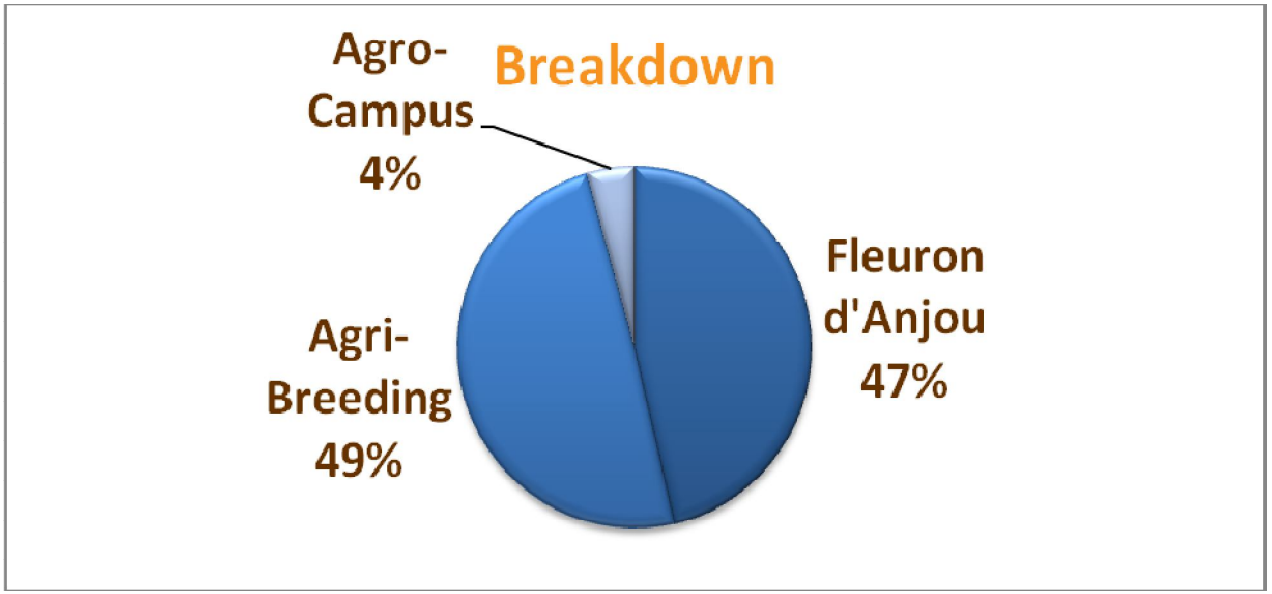
MELKIOR, the first programme-based variety to be registered in the catalogue
(mildew resistant; certified organic)



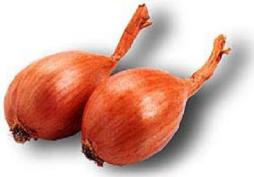
Initial “shallot” budget

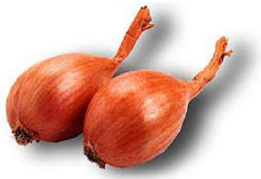
207,000 €



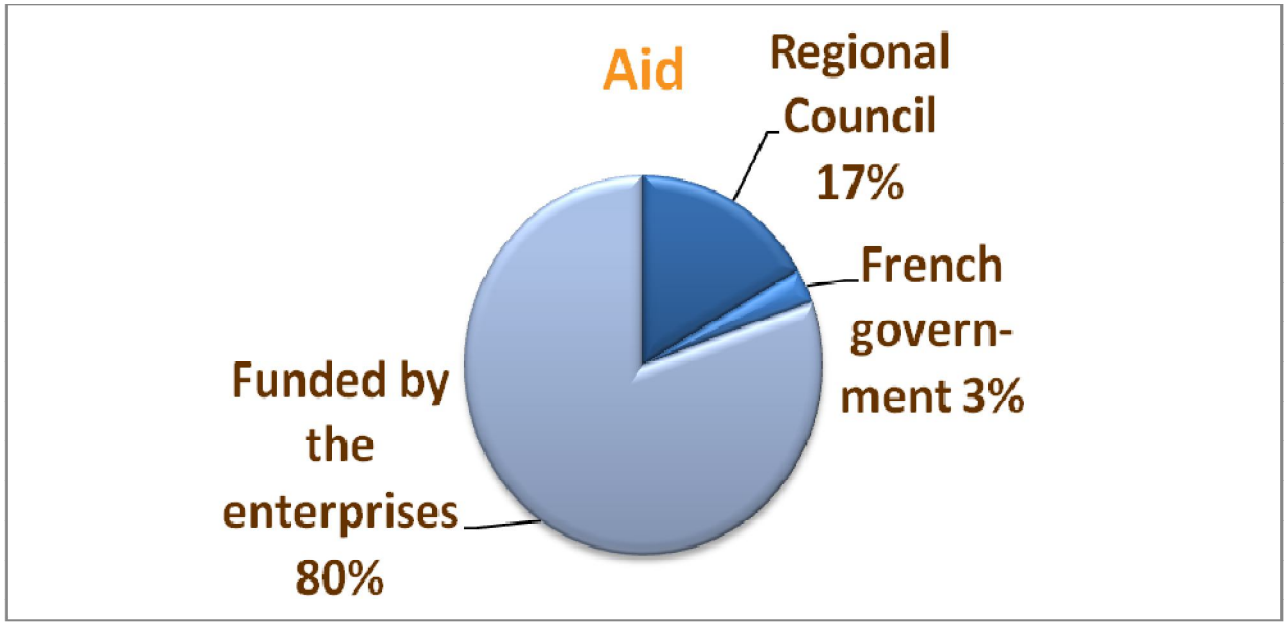
The “Legtyp” provisional budget for the three years was **312,350 €.**

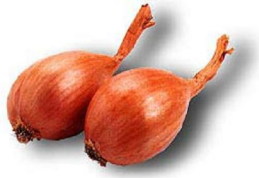
After completion of the study, it was exceeded by **+ 11%.**



Financing of the total costs





The Jerusalem artichoke in Anjou

1st place in France on the fresh produce market

More than 60 ha in Maine et Loire

of which Fleuron d'Anjou :

35 ha
15 farms
600 tonnes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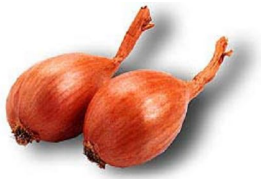
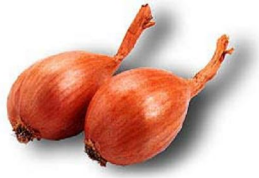


Jerusalem artichoke
Evaluation at the end of the 3rd year

Selection from about twenty cultivars of three separate clones of the purple type

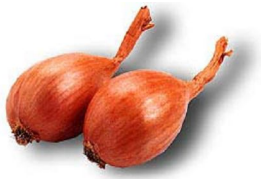
With interesting behaviour in production and processing for 5th range.



Cornet d’Anjou

1st place in France…



Cornet d'Anjou chicory
Evaluation at the end of the 3rd year

- **Already some promising lines**
- **Sensory analysis of the lines to understand consumer expectations**
- **Important selection work still has to be carried out (acquisition of chemical descriptors essential) to plan registration of the first varieties within 3 to 4 years.**